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Relativistic Fermions Generated by Square Lattices in Layered Compounds[1]

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Recent discoveries of topological semimetals have generated immense interests since they represent new topological states of quantum matters. In this talk, I will present our recent studies on topological semimetals [1-4], which are focused on Dirac/Weyl fermions generated by square lattices in layered compounds. I will first report on our discoveries of two new Dirac materials Sr1-yMn1-zSb2 [1] and BaMnSb2 [2] in which nearly massless Dirac fermions are generated by 2D Sb layers. In Sr1-yMn1-zSb2, Dirac fermions are found to coexist with ferromagnetism, offering a rare opportunity to investigate the interplay between relativistic fermions and spontaneous time reversal symmetry breaking and explore a possible magnetic Weyl state. Then I will show our quantum oscillation studies on two new Dirac nodal line semimetals – ZrSiSe and ZrSiTe [3]. We have not only revealed their signatures of nodal-line fermions, but also demonstrated that their atomically thin crystals are accessible via mechanical exfoliation, raising the possibility of realizing the theoretically predicted 2D topological insulators [5]. Finally I will discuss exotic quantum transport behavior arising from the zeroth Landau level in Weyl semimetal $YbMnBi_2$ [4,6]. References: [1] Liu et al., arXiv:1507.07978. [2] Liu et al., Sci. Rep. 6, 30525 (16). [3] Hu et al., PRL **117**, 016602 (16). [4] Liu et al., arXiv: 1608.05956 [5] Q. Xu et al., PRB 92, 205310 (15). [6] Borisenko et al., arXiv: 1507.04847 (12).

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